

# EXAMINATIONS COUNCIL OF ZAMBIA

Joint Examination for the School Certificate  
and General Certificate of Education Ordinary Level

## MATHEMATICS (SYLLABUS D) 4024/2 PAPER 2

Tuesday

2 NOVEMBER 2010

2 hours 30 minutes

Additional materials:

Answer paper

Silent Electronic Calculator (non programmable)

Geometrical instruments

Graph paper (4 sheets)

Mathematical tables (optional)

Plain paper (1 sheet)

TIME: 2 hours 30 minutes

### INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Answer Booklet.

Write your answers and working in the Answer Booklet provided.

If you use more than one Answer Booklet, fasten the Answer Booklets together.

Commission of essential working will result in loss of marks.

There are **twelve (12)** questions in this paper.

### Section A

Answer **all** questions.

### Section B

Answer any **four** questions.

**Silent non programmable Calculators or Mathematical tables may be used.**

**Cell phones should not be brought into the examination room.**

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 100.

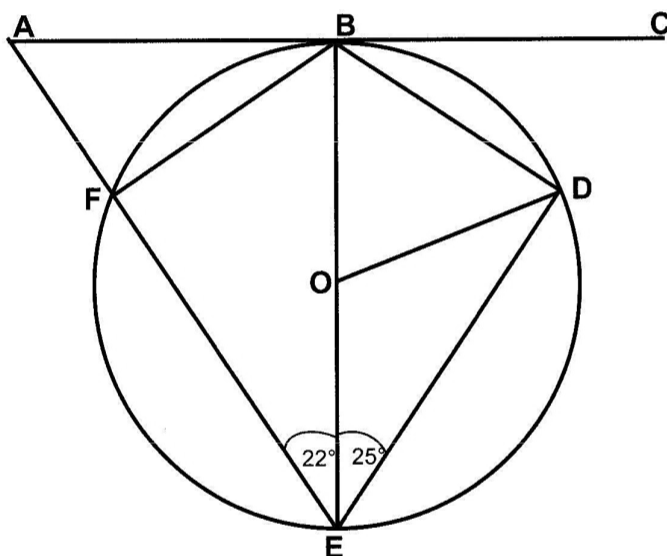
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

# Section A [52 marks]

Answer all questions in this section.

- 1 (a) Factorise completely  $5 - 20x^2$ . [2]
- (b) Solve the equation  $2(2x - 5) + 2 = x + 7$ . [3]
- (c) Express  $\frac{2}{1-3x} + \frac{4}{5+x}$  as a single fraction in its simplest form. [3]

- 2 (a) Solve the equation  $7 - 5x - x^2 = 0$ , giving your answers correct to 2 decimal places. [5]
- (b) In the diagram below, ABC is a tangent and O is the centre of the circle. BE is the diameter,  $\angle DEO = 25^\circ$  and  $\angle FEO = 22^\circ$ .



Calculate

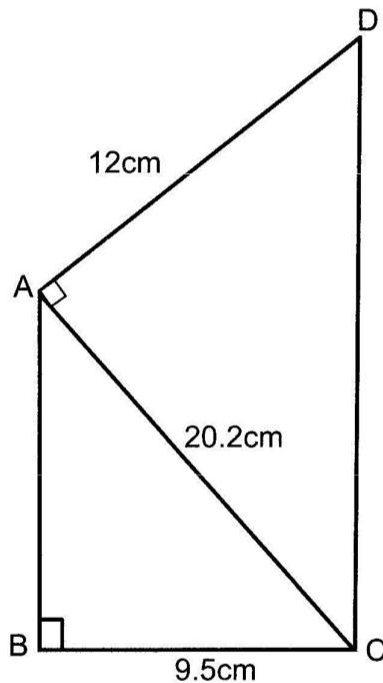
- (i)  $\angle BOD$ , [1]
- (ii)  $\angle CBD$ , [1]
- (iii)  $\angle DBF$ . [1]

- 3 (a) Given that  $d = \frac{p+y}{5y}$ , express y in terms of d and p. [3]
- (b) Given that  $2x - 7y - 1 = 0$ , find the gradient of this equation. [1]
- (c) If  $P = \begin{pmatrix} 2 & 0 \\ 6 & 1 \end{pmatrix}$  and  $Q = \begin{pmatrix} a & 0 \\ 1 & b \end{pmatrix}$ , find
- (i) PQ, [2]
- (ii) the values of a and b, given that  $PQ = P - Q$ . [3]

4 Answer the whole of this question on a sheet of plain paper.

- (a) Construct triangle DEF in which  $EF = 10\text{cm}$ ,  $\angle DEF = 38^\circ$  and  $\angle DFE = 95^\circ$  [1]
- (b) On your diagram, draw the locus of points which are:
- (i) 4.5cm from F, [1]
- (ii) equidistant from DE and EF. [2]
- (c) P is a point inside the triangle DEF such that it is 4.5cm from F and is equidistant from DE and EF. Label the point P. [1]
- (d) Measure and write down the length of EP. [1]

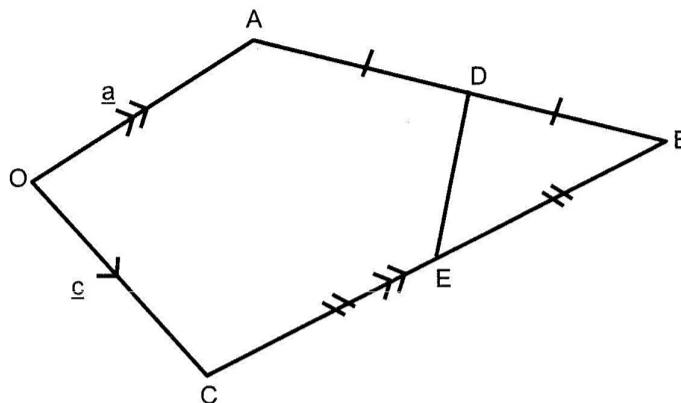
- 5 In the diagram below, triangles ABC and ACD are right angled.  $\angle ABC = \angle CAD = 90^\circ$ ,  $AC = 20.2\text{cm}$ ,  $BC = 9.5\text{cm}$  and  $AD = 12\text{cm}$ .



Calculate

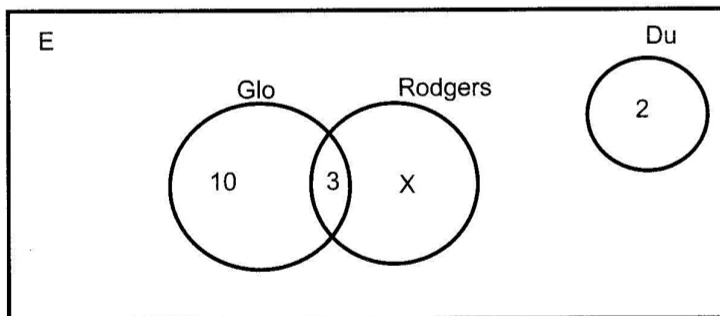
- (a)  $AB$ , [2]
- (b)  $\angle BAC$ , [2]
- (c) the area of quadrilateral ABCD, [3]
- (d) the perimeter of quadrilateral ABCD. [3]

- 6 (a) The diagram below shows a trapezium in which  $\vec{OA} = \underline{a}$ ,  $\vec{OC} = \underline{c}$  and  $\vec{CB}$  is parallel to  $\vec{OA}$ .  $\vec{CB}$  is twice  $\vec{OA}$ , the points D and E are midpoints of AB and CB respectively.



Express in terms of  $\underline{a}$  and/or  $\underline{c}$  the following vectors

- (i)  $\vec{CA}$ , [1]
  - (ii)  $\vec{AB}$ , [1]
  - (iii)  $\vec{EB}$ , [2]
  - (iv)  $\vec{OD}$ , [2]
  - (v)  $\vec{BO}$ . [1]
- (b) At one college, a group of 25 students were asked which Cell Phone service providers they subscribed to. The results are shown in the Venn diagram below.

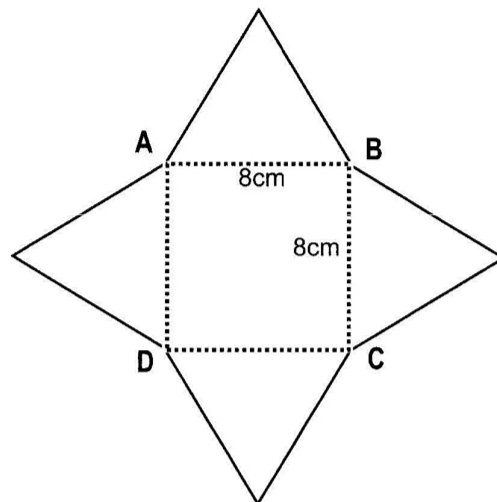


- (i) Calculate the value of x. [1]
- (ii) Given that  $G = \{\text{Glo}\}$ ,  $R = \{\text{Rodgers}\}$  and  $D = \{\text{Du}\}$ , find,
  - (a)  $n(G \cap R)$  [1]
  - (b)  $n(D \cup G')$ . [2]

**Section B [48 marks]**

Answer any **four** questions in this section  
Each question in this section carries 12 marks.

- 7 (a) The figure below shows the net of a pyramid with a square base ABCD of side 8cm.



Given that each of the triangles is an equilateral triangle, calculate

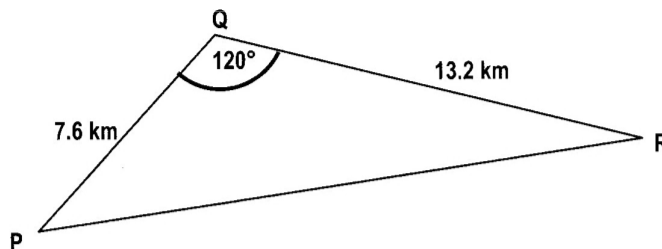
- (i) the perimeter of the net, [1]  
 (ii) the area of the figure in square centimeters, correct to 3 significant figures. [3]  
 (iii) the volume of the pyramid when the shape is folded along the dotted lines.

[volume of pyramid =  $\frac{1}{3}$  base area  $\times$  perpendicular height] [3]

- (b) (i) Given that  $x = 7$  and  $y = -9$ , find the value of  $3x - y$ . [2]

(ii) Simplify  $\frac{3y^2 - 5y - 12}{y^2 - 9}$ . [3]

- 8 P, Q and R are fishing camps along the banks of Lake Kariba joined by straight paths PQ, QR and RP. P is 7.6 km from Q, and Q is 13.2 km from R and  $\angle PQR = 120^\circ$ .



- (a) Calculate
- (i) the distance PR, [5]
  - (ii) the area of triangle PQR. [3]
- (b) Find the shortest distance from Q to PR. [2]
- (c) A fisherman takes 30 minutes to move from R to P. Calculate his average speed in km/h. [2]

9 Answer the whole of this question on a sheet of graph paper.

The variables  $x$  and  $y$  are connected by the equation  $y = \frac{1}{5}x(10 - x^2)$ .

The table below shows some corresponding values of  $x$  and  $y$ . The values of  $y$  are given correct to one decimal place where necessary.

X	-1	0	1	2	3	3.5	4
y	-1.8	0	1.8	2.4	0.6	-1.6	p

- (a) Calculate the value of  $p$ . [1]
- (b) Using a scale of 2 cm to represent 1 unit on both axes for  $-1 \leq x \leq 5$  and  $-5 \leq y \leq 3$ , draw the graph of  $y = \frac{1}{5}x(10 - x^2)$ . [3]
- (c) By drawing a tangent to the curve, estimate the gradient of the curve at the point (1, 1.8). [2]
- (d) On the same graph, draw the line whose equation is  $5y + 4x = 4$ . [2]
- (e) Use your graphs to find the solutions of  $\frac{1}{5}x(10 - x^2) = -\frac{4}{5}x + \frac{4}{5}$ . [2]
- (f) Estimate the area under the curve between  $x = 1$ ,  $x = 3$  and the line  $y = 0$ . [2]

**Answer the whole of this question on a sheet of graph paper.**

- 10** The following table shows the total number of points scored by 110 candidates at Mingule High School, in the 2007 Grade 12 Final Examinations.

Points scored	$6 < x \leq 8$	$8 < x \leq 10$	$10 < x \leq 12$	$12 < x \leq 14$	$14 < x \leq 16$	$16 < x \leq 20$
Frequency	13	16	9	15	22	35

- (a) Calculate the estimated mean points scored. [2]  
 (b) Copy and complete the table showing the cumulative frequency distribution. [2]

Points scored	$\leq 6$	$\leq 8$	$\leq 10$	$\leq 12$	$\leq 14$	$\leq 16$	$\leq 20$
Frequency	0	13					110

- (c) Using a horizontal scale of 2cm to represent 2 points on the X-axis and a vertical scale of 2cm to represent 10 candidates on the Y-axis, draw a smooth cumulative frequency curve. [3]  
 (d) Use your graph to find the median points scored. [2]  
 (e) A scholarship was offered to two candidates. Find the probability that the two candidates chosen scored less than 14 points. [2]  
 (f) Selection to the University of Zambia was done and only those who scored 14 points or less were selected. How many candidates were not selected from this group? [1]

**Answer the whole of this question on a sheet of graph paper.**

- 11** Mr. Simukadi intends to buy a total of 500 scratch cards from Unitel and Bitel. He decides to buy Bitel scratch cards which must be at least one third of Unitel scratch cards. He wants to buy at least 150 Bitel scratch cards and not more than 300 Unitel scratch cards. Let  $x$  be the number of Unitel scratch cards and  $y$  be the number of Bitel scratch cards.

- (a) Write down four inequalities which satisfy the above conditions. [4]  
 (b) Show these inequalities on a graph paper using 2cm to represent 100 scratch cards on both axes. [4]  
 (c) The dealer makes a profit of K500 on each Unitel scratch card and K150 on each Bitel scratch card sold.  
 (i) Find the number of scratch cards of each type he must buy in order to maximize his profit. [2]  
 (ii) Calculate the maximum profit. [2]

**Answer the whole of this question on a sheet of graph paper.**

- 12 (a)** Using a scale of 1cm to represent 1 unit on each axis, draw x and y axes for  $-5 \leq x \leq 8$  and  $2 \leq y \leq 12$ . Draw and label  $\triangle PQR$  whose vertices are  $P(5,2)$ ,  $Q(1,1)$  and  $R(3,6)$ . [1]
- (b)** An enlargement maps  $\triangle PQR$  onto  $\triangle PAB$ . Given that the co-ordinates of A are  $(-3,0)$ , find
- (i)** the centre of enlargement, [1]
  - (ii)** the scale factor, [1]
  - (iii)** the co-ordinates of the point B, [1]
  - (iv)** the ratio of the area of  $\triangle PAB$  to  $\triangle PQR$ . [1]
- (c)** Given that C is the point  $(2,5)$ , D is the point  $(6,3)$  and that a single transformation maps  $\triangle PQR$  onto  $\triangle CQD$ ,
- (i)** describe fully the single transformation, [2]
  - (ii)** write down the matrix of this transformation. [1]
- (d)** Given that PQRS is a parallelogram,
- (i)** write down the co-ordinates of S, [1]
  - (ii)** describe the transformation which maps  $\triangle PQR$  onto  $\triangle RSP$ . [3]
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